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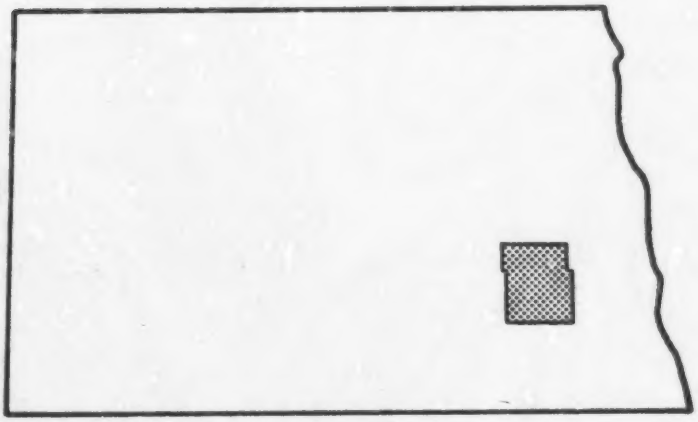
COMPLETED

FLOOD INSURANCE STUDY

ORIGINAL

BARNES COUNTY, NORTH DAKOTA
UNINCORPORATED AREAS



Federal Emergency Management Agency

COMMUNITY NUMBER - 380339

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NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
BARNES COUNTY, UNINCORPORATED AREAS, NORTH DAKOTA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in Barnes County, North Dakota and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE), St. Paul District, for the Federal Emergency Management Agency (FEMA), under InterAgency Agreement No. IAA-EMW-E-1153, Project Order No. 1, Amendment No. 27. This study was completed in July 1985.

1.3 Coordination

Streams requiring detailed study and study limits were initially identified during a telephone conversation between a representative of FEMA Region VIII and the study contractor. Further details of the study and the establishment of study limits were discussed during a subsequent meeting on July 18, 1983, held in the county offices in the City of Valley City. Attending the meeting were representatives of the county and the study contractor.

A floodway alignment meeting was held in the county offices on March 6, 1985. Attending the meeting were representatives of the county, Valley City, the North Dakota State Water Commission, FEMA, and the study contractor.

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On July 16, 1986, the results of the study were reviewed at the final meeting attended by representatives of the county, FEMA and the study contractor. The study was acceptable to the county.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Barnes County, North Dakota. The area of study is shown on the Vicinity Map (Figure 1).

The Sheyenne River was studied in detail from the extraterritorial jurisdictional limits of Valley City downstream 17.8 miles to a point 6000 feet upstream of the FAS 603 S. 15/22 bridge. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through September 1990.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA, representatives of the county, Valley City, the North Dakota State Water Commission, and the study contractor.

2.2 Community Description

Barnes County is located in the southeastern portion of North Dakota, approximately 120 miles east of Bismarck, North Dakota; 45 miles west of Fargo, North Dakota; and 240 miles northwest of Minneapolis, Minnesota. Barnes County is bordered by Ransom, Cass, LaMoure, Stutsman, Griggs, and Steele Counties. The total land area within the county is approximately 850 square miles. The 1980 county population was 13,960 (Reference 1). The economy of the county depends primarily on agricultural and related enterprise.

The Sheyenne River flows in a general southward direction through Barnes County. Originating in Sheridan County, North Dakota, it flows eastward through Wells, Benson, Eddy, and Nelson Counties before flowing southerly through Griggs, Barnes and Ransom Counties. To the east of the City of Lisbon in Ransom County, it curves northeastward and flows in a general northerly direction to join the Red River of the North just north of Fargo, North Dakota. The Sheyenne River has a total drainage area of approximately 4,163 square miles above Valley City, of which 602 square miles are non-contributing (Reference 2).

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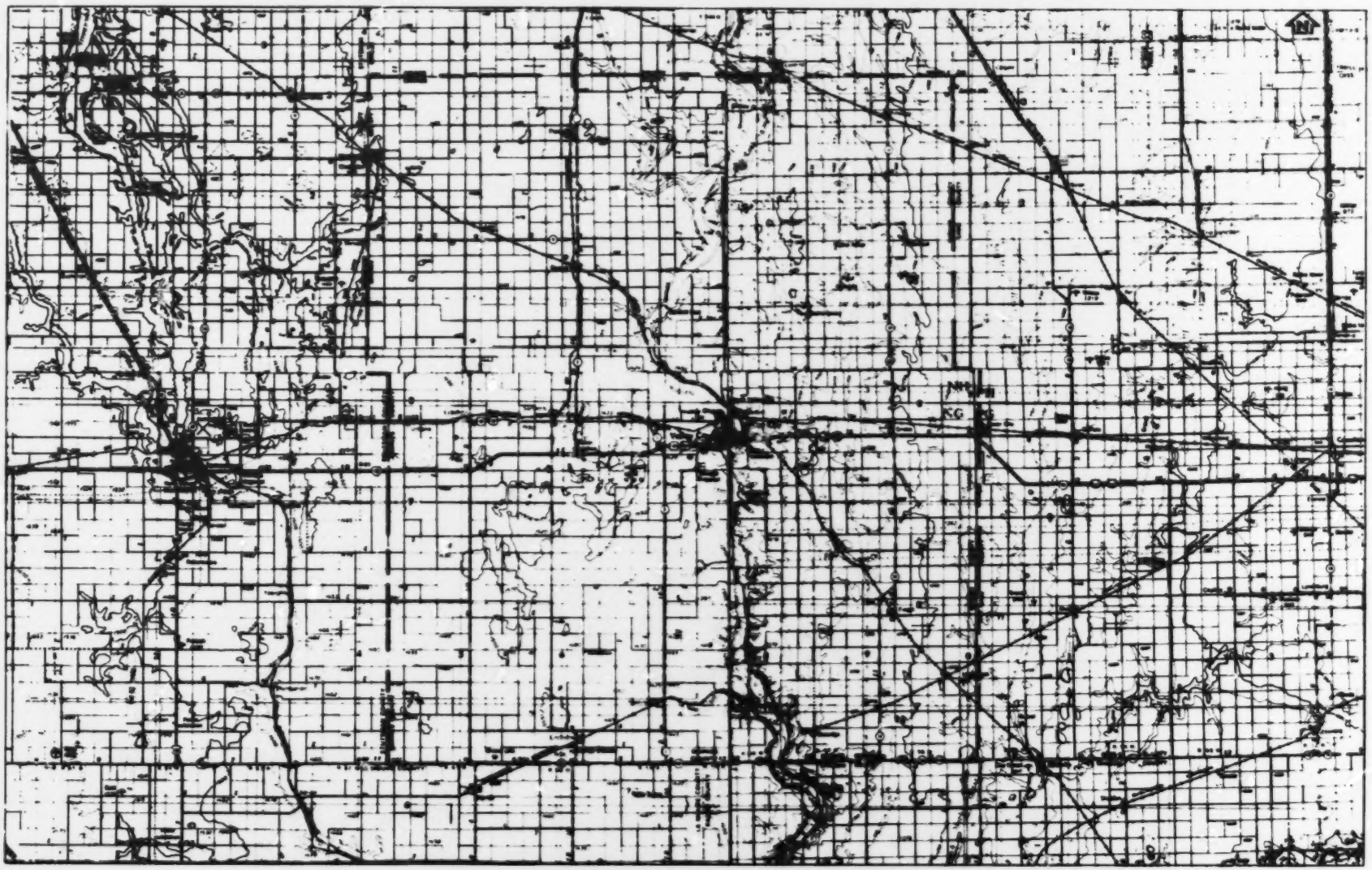

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BARNES COUNTY

(NORTH DAKOTA)

APPROXIMATE SCALE

5 0 5 10 15 MILES

VICINITY MAP

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The climate of Barnes County is typical of the Great Plains. Summers are warm and pleasant with sunny days and cool nights. Maximum temperature during December, January, and February averages 10.1° F. During outbreaks of cold arctic air, the temperature drops to zero or below for extended periods each year. The annual precipitation is approximately 19 inches. Snowfall averages approximately 36 inches annually (Reference 3).

The fertile Sheyenne River floodplain promotes agriculture as the primary industry of Barnes County. Soils in the county have developed on undulating to rolling and hilly glacial drifts, and on level former glacial lakes and outwash plains. The soils include sandy loams, loams, and clay loams. Most of the county is mantled with glacial drifts. The uplands are covered with till and associated glaciofluvial deposits, but bedrock of the late Cretaceous Age is exposed in the valley of the Sheyenne River. The Sheyenne River has eroded more than 150 feet below the adjacent plains and has exposed the Pierre Formation from Valley City southward to the Niobrara contact near the Ransom County line (Reference 2).

2.3 Principal Flood Problems

The most severe flooding in Barnes County occurs as a result of spring snowmelt and/or rainfall. Major floods in recent years occurred in May 1979, April 1969, April 1950, and April 1947. The flood of record in Valley City, located near the center of Barnes County, occurred in July 1975. Table 1 presents the historic flood data for the U.S. Geological Survey (USGS) Gage No. 05058500 at Valley City (Reference 4).

TABLE 1. HISTORIC FLOOD DATA[1]
SHEYENNE RIVER, VALLEY CITY, NORTH DAKOTA

Date	Maximum Stage (feet)	Peak Discharge (cfs)	Estimated Recurrence Interval (years)
April 19, 1969	17.62[2]	4,520	38
April 28, 1948	17.51	4,580	38
April 16, 1965	14.93[2]	3,080	9
April 18, 1919	14.90	2,750	4
May 5, 1950	14.60[2]	3,050	9
March 28, 1966	14.27[2]	3,350	12

[1] Gaging station operation discontinued in 1976 and reestablished in 1980. Therefore, historic data for the 1978 and 1979 floods are not available.
[2] Stage values represent regulated flows from Baldhill Dam from 1950 to present.

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2.4 Flood Protection Measures

Some local flood protection measures have been constructed on or along the Sheyenne River in Barnes County, though they do not meet FEMA requirements. Therefore, for the purposes of this Flood Insurance Study, it is assumed that these structures are ineffective. The major flood-control facility benefitting the County is the Baldhill Dam. Located 18 miles upstream of Valley City, the Baldhill Dam was constructed in the 1950's. It was authorized, constructed, and is operated by the COE as a multi-purpose structure. Major purposes include downstream water supply, flood control, and recreation.

The St. Paul District COE is currently investigating basin-wide Sheyenne River flood damage reduction measures (Reference 2). However, since the study is only in the planning stages and construction of various flood control works has not been approved, authorized, or funded, any future Sheyenne River flood damage reduction benefits in Barnes County have not been considered in this study.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1 and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

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Peak discharges for the Sheyenne River at Barnes County were developed using data available at the gaging stations at Valley City and Lisbon (Reference 4). Peak discharges used for these stations reflect the current operation of Baldhill Dam, upstream of Valley City.

Peak discharge-drainage area relationships for the Sheyenne River in Barnes County are shown in Table 2.

TABLE 2. SUMMARY OF DISCHARGES

Sheyenne River at Location	Drainage Area (square miles) Primary	Secondary	10-year[1]	50-year[1]	100-year[2]	500-year[2]
Downstream Corporate Limits of Valley City	1,824	1,737	3,200	5,400	9,400	18,000
FAS 603, S. 3/10	1,931	1,737	3,470	5,970	9,800	20,400

[1] Includes primary drainage areas only.
[2] Includes primary and secondary drainage areas.
Note: Devils Lake Basin has been excluded.

Primary drainage areas are those with a direct watercourse to the flooding source; secondary drainage areas are those which contribute to flood flow in events of greater than 50-year magnitude.

The peak discharge-drainage area relationships for the Sheyenne River have been coordinated with the North Dakota Water Commission, FEMA, the USGS, and the North Dakota Soil Conservation Service.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Overbank cross section data and below-water sections (soundings) for the backwater analyses of the Sheyenne River were obtained by field measurement (Reference 5). All bridges, dams, and culverts were field-surveyed to obtain elevation and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

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Water-surface elevations of floods of the selected recurrence intervals were computed through the use of the COE HEC-2 step-backwater computer program (Reference 6). The computer model of the Sheyenne River was calibrated using the historical flood profiles of the 1969 Sheyenne River flood.

Roughness factors (Manning's "n") used in the hydraulic computation were chosen by engineering judgement and are based on field observation of the streams and floodplain area. The roughness values selected for the main channel of the Sheyenne River ranged from 0.040 to 0.100, whereas, the overbank roughness values ranged from 0.045 to 0.100.

Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the hydraulic model were calculated based on normal depth computations.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the description of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000, with a contour interval of 10 feet (Reference 7).

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The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE); and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2). Approximate 100-year floodplain boundaries in some portions of the study area were taken directly from the USGS flood-prone maps (Reference 8).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. In North Dakota standards limit floodway stage increases to 1.0 foot. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study reflect a county selected alignment. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated at selected cross sections (Table 3). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
Sheyenne River								
A (3)	6,000	830	6080	1.6	1195.7	1195.7	1196.2	+0.5
B (4)	10,850	1080	6650	1.5	1196.4	1196.4	1197.2	0.8
C (5)	13,000	580	6910	1.4	1196.8	1196.8	1197.6	0.8
D (6)	16,890	1130	7300	1.3	1197.3	1197.3	1198.1	0.8
E (7)	19,270	580	5170	1.9	1197.9	1197.9	1198.6	0.7
F (8.06)	22,400	710	2930	3.3	1198.7	1198.7	1199.3	0.6
G (9)	26,240	1220	9080	1.1	1199.7	1199.7	1200.0	0.3
H (10)	30,620	1870	9730	1.0	1200.5	1200.5	1200.7	0.2
I (11)	36,880	920	7490	1.3	1201.6	1201.6	1201.7	0.1
J (12)	40,000	1370	8920	1.1	1202.1	1202.1	1202.2	0.1
K (13)	47,570	660	4060	2.4	1203.6	1203.6	1203.8	0.2
L (14.06)	50,940	110	1850	5.2	1205.3	1205.3	1205.3	0.0
M (15)	58,420	1060	7490	1.3	1207.1	1207.1	1207.5	0.4
N (16)	66,400	490	4940	1.9	1208.4	1208.4	1209.1	0.7
O (17)	69,530	850	5600	1.7	1209.2	1209.2	1209.8	0.6
P (18.06)	74,095	620	3900	2.4	1210.2	1210.2	1210.7	0.5
Q (19)	81,590	770	5590	1.7	1211.2	1211.2	1212.1	0.9
R (20.06)	84,010	580	2520	3.7	1211.8	1211.8	1212.8	1.0
S (21)	87,890	1300	6740	1.4	1213.0	1213.0	1214.0	1.0
T (22)	92,300	900	6610	1.4	1213.8	1213.8	1214.8	1.0
U (23)	94,370	620	5620	1.7	1214.2	1214.2	1215.2	1.0
V (24.06)	96,020	350	3170	3.0	1214.6	1214.6	1215.6	1.0

[1] Stream distance in feet above FAS 603 S. 15/22.

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TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

BARNES COUNTY, ND
(UNINCORPORATED AREAS)

FLOODWAY DATA

SHEYENNE RIVER

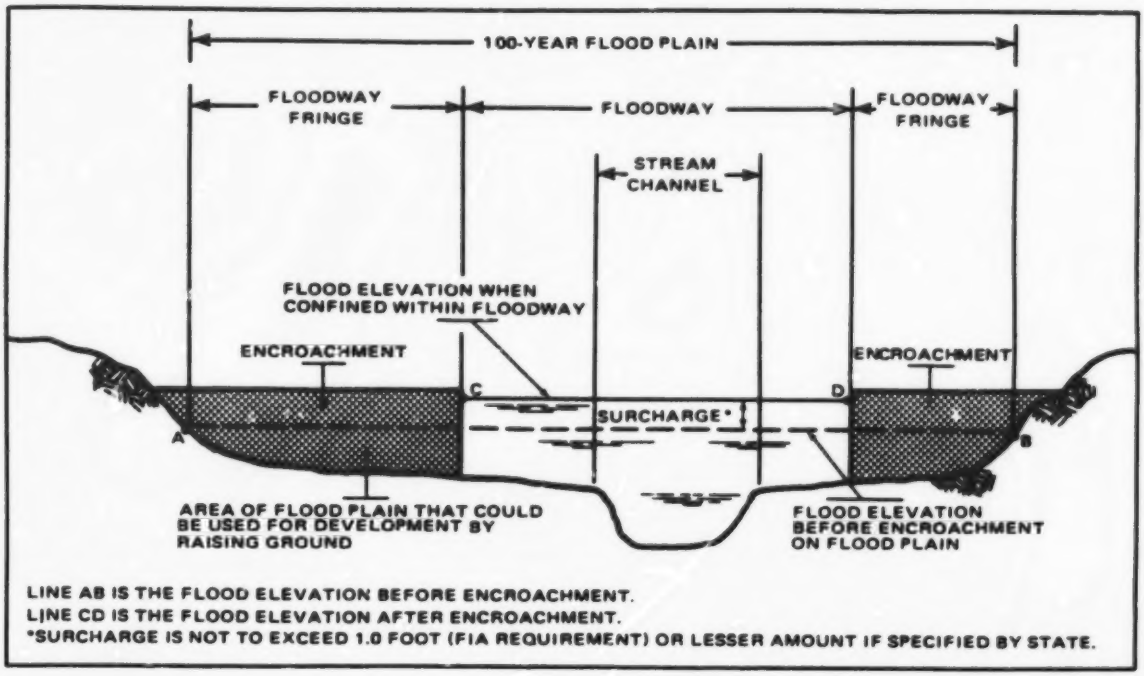
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 2. Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

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Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

The St. Paul District COE is investigating basin-wide the Sheyenne River flood control (Reference 2). The investigation addresses basin-wide flood control and proposes a number of solutions to future flood problems. This Flood Insurance Study is in agreement with the data presented in the COE report.

The Flood Insurance Study for the City of Valley City, North Dakota is currently being revised by FEMA (Reference 9). The results of this study match exactly the results of the City of Valley City study.

A Flood Insurance Study has been published for the City of Kathryn, North Dakota (Reference 10). The results of this study match those for the City of Kathryn Flood Insurance Study.

FEMA published a Flood Hazard Boundary Map for Barnes County (Reference 11) in April 1978. Because of the more detailed and current hydrologic analysis, this Flood Insurance Study supersedes the data presented on the Flood Hazard Boundary Map on the Sheyenne River.

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8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267.

9.0 BIBLIOGRAPHY AND REFERENCES

1. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population and Housing, North Dakota.

2. U.S. Department of the Army, Corps of Engineers, St. Paul District, General Reevaluation and Environmental Impact Statement for Flood Control and Related Purposes, Sheyenne River, North Dakota, August 1982.

3. U.S. Department of Agriculture, Statistical Reporting Service, North Dakota Agricultural Statistics, 1985.

4. U.S. Department of the Interior, Geological Survey, Water Resources Data for North Dakota, Surface Water Records, May 1, 1981.

5. K.B.M., Inc., Grand Forks, North Dakota.

6. U.S. Department of the Army, Hydrologic Engineering Center, Computer Program 723-X6-L202A, HEC-2 Water-Surface Profiles, Davis, California, March 1982.

7. U.S. Department of the Interior, Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 10 feet : Fingal Southwest (1967), Kathryn (1967), Sanborn Southeast (1970), Valley City East (1961), Valley City West (1961).

8. U.S. Department of the Interior, Geological Survey, 7.5 Minute Series Flood-prone Maps, Scale 1:24,000, Contour Interval 10 feet : Fingal SW (1967), Kathryn (1967), Valley City E (1961), Valley City W (1961).

9. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, City of Valley City, North Dakota, (revision unpublished).

10. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, City of Kathryn, North Dakota, July 19, 1982.

11. Federal Emergency Management Agency, Federal Insurance Administration, Flood Hazard Boundary Map, Barnes County, Unincorporated Areas, North Dakota, April 19, 1978.

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EXHIBIT 3 - ELEVATION REFERENCE MARKS
BARNES COUNTY, UNINCORPORATED AREAS, NORTH DAKOTA

Reference Mark	Elevation (feet NGVD)	Description of Location
RM 1	1214.40	Brass cap, reset 1967, at the intersection of county road 21 and FAS 603 S 22 southeast corner.
RM 2	1192.25	East bolt of two, on the northwest piling of the FAS 603 S 22 bridge.
RM 3	1198.70	An 'x', at the center of the north railing of the FAS 603 S 3/10 bridge.
RM 4	1207.81	Chiseled square, at the northeast corner of the FAS 603 S 28/27 bridge.
RM 5	1209.35	Top of insulator, east corner, in S 21, 1350 feet west of the centerline of the Sheyenne River.
RM 6	1217.89	Spike in power pole, 50 feet south of FAS 603 S 16/21 and 50 feet west of county road 21, just southwest of the intersection.
RM 7	1207.53	Chiseled 'x', on the southeast corner of the FAS 603 S 16/21 bridge.
RM 8	1209.69	Chiseled square, on top of the wingwall, southwest corner of the FAS 603 S 9 bridge.
RM 9	1210.98	Chiseled square, on top of the wingwall, southwest corner of the FAS 603 S 4/3 bridge.

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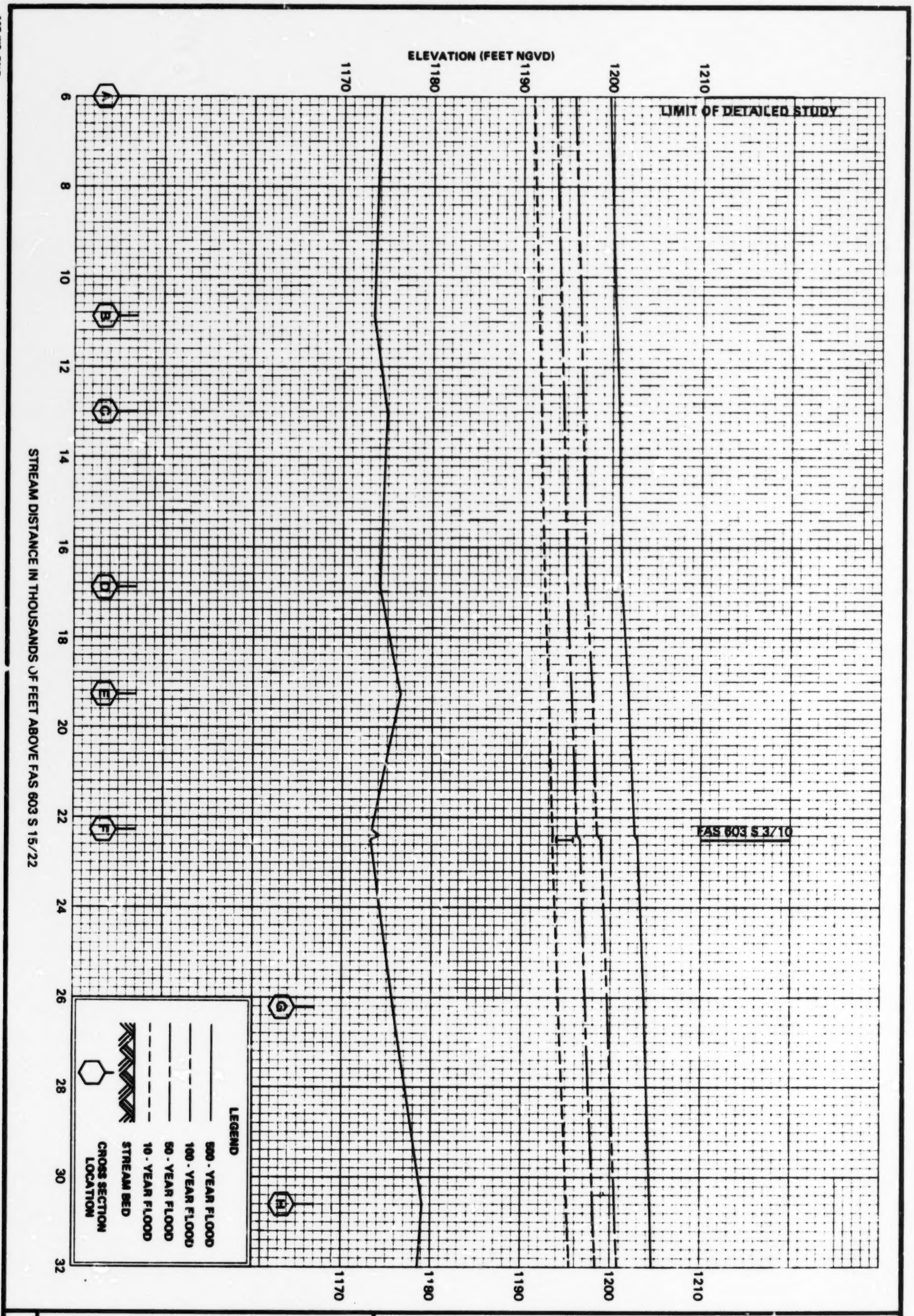

FEDERAL EMERGENCY MANAGEMENT AGENCY

BARNES COUNTY, ND
(UNINCORPORATED AREAS)

FLOOD PROFILES

SHEYENNE RIVER

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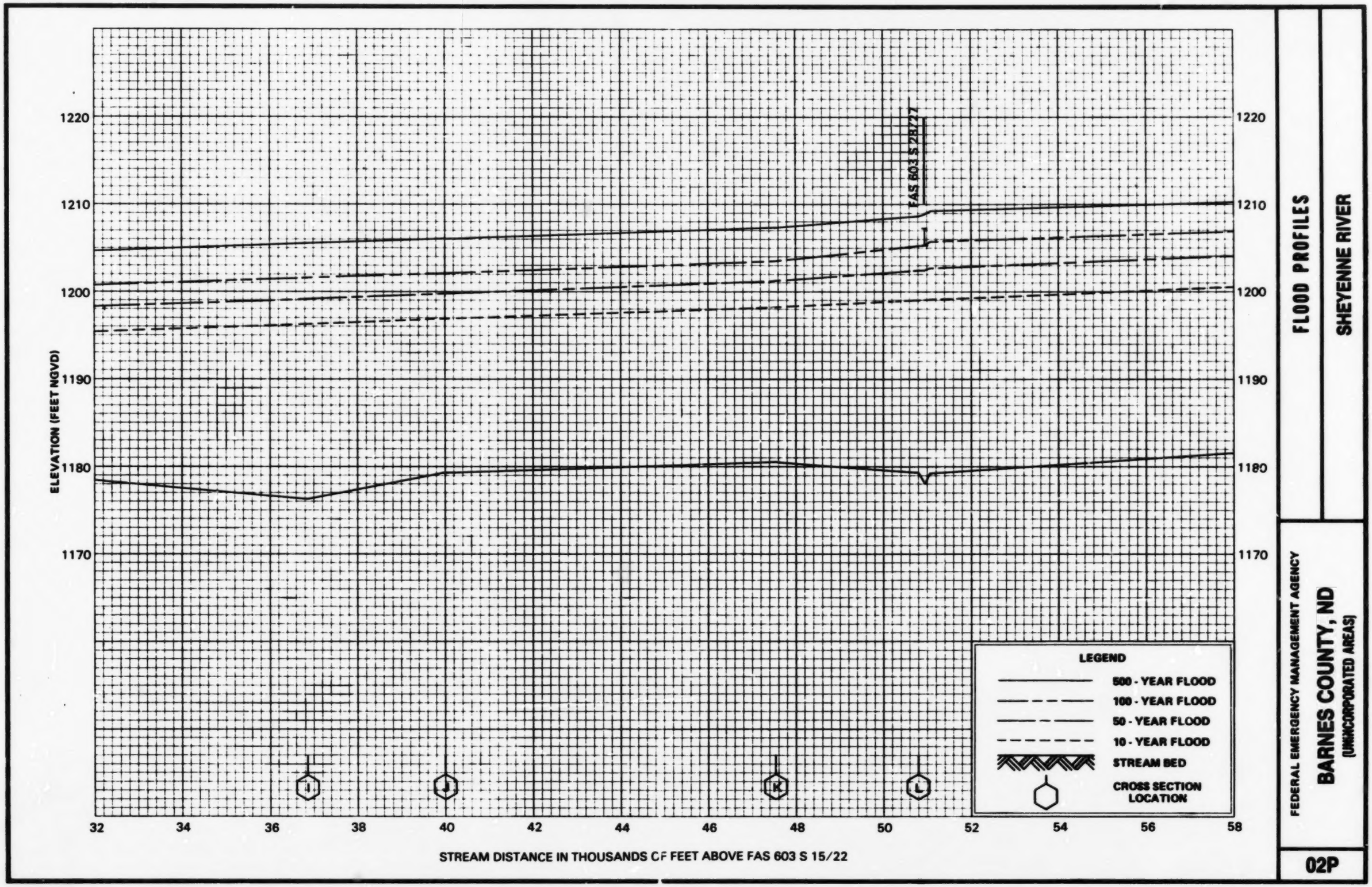

FLOOD PROFILES

SHEYENNE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BARNES COUNTY, ND
(UNINCORPORATED AREAS)

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ASE INC-BALT

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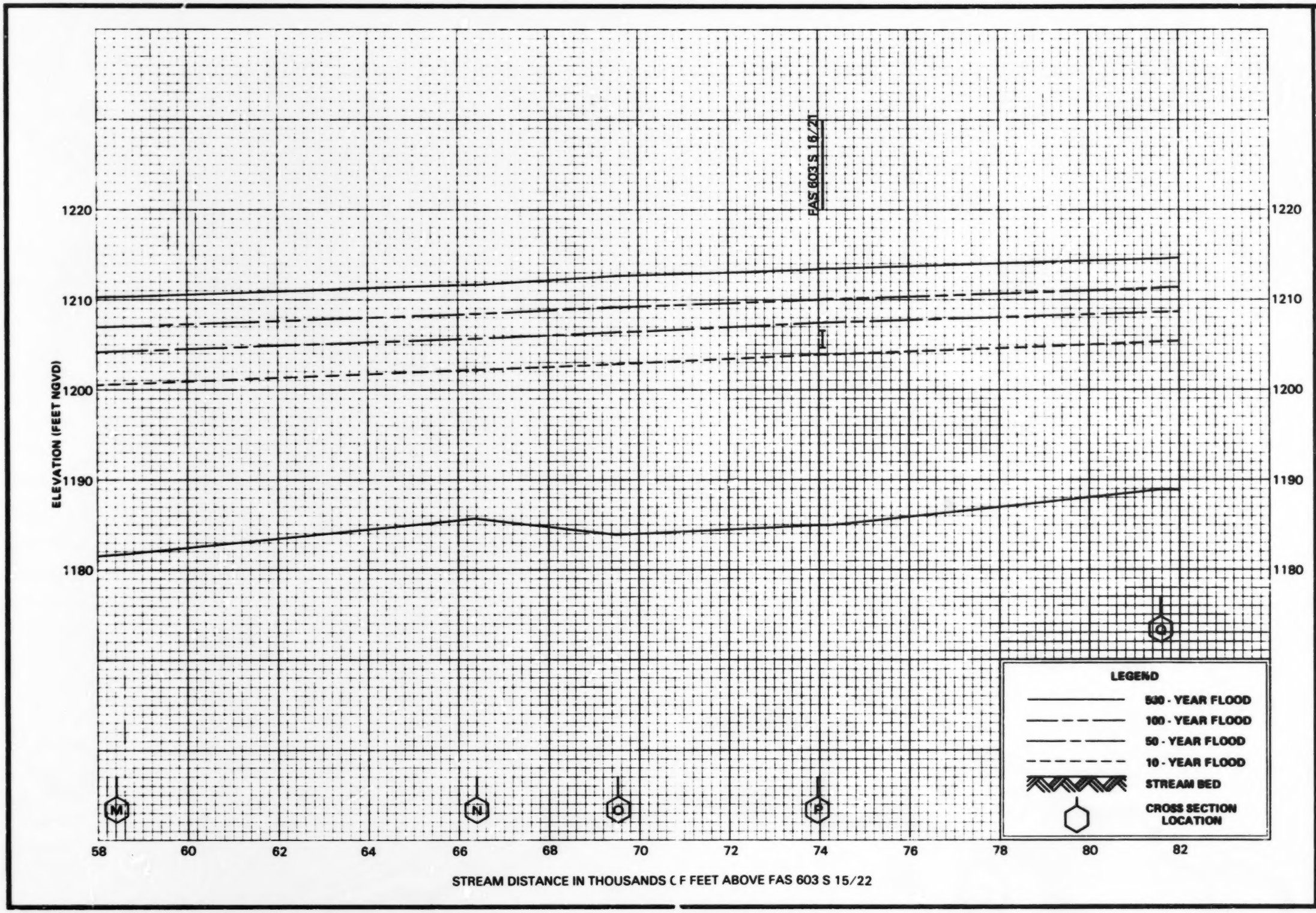

FLOOD PROFILES

SHEYENNE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BARNES COUNTY, ND
(UNINCORPORATED AREAS)

03P

ABE INC-SALT

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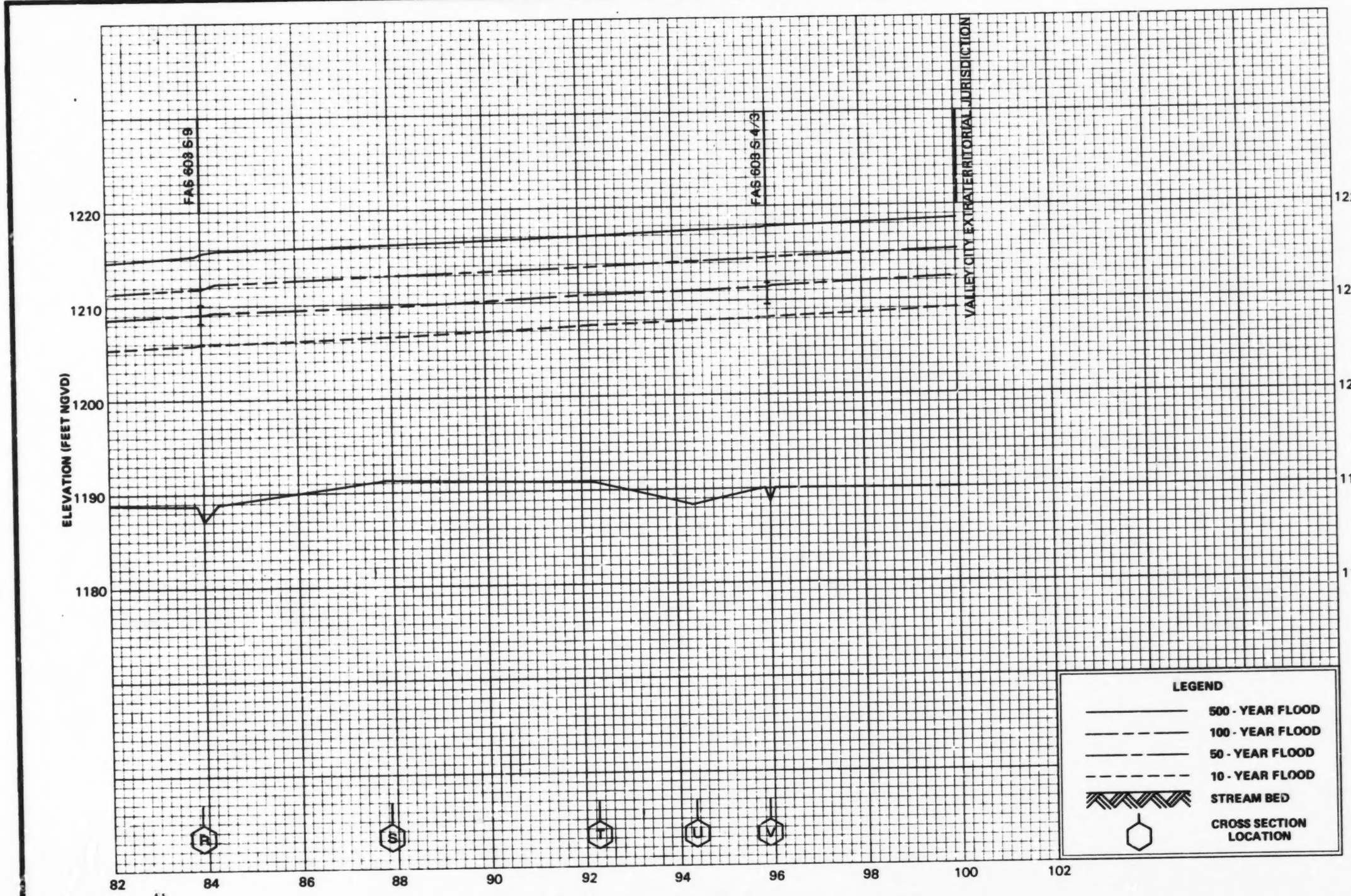

FLOOD PROFILES

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